Modeling 10 GeV laser-plasma accelrators and conventional accelerators using boosted computational frames

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It can be computationally advantageous to perform computer simulations in a Lorentz boosted frame for a certain class of particle acceleration devices or problems such as: free electron laser, laser-plasma accelerator, particle beams interacting with electron clouds [1]. Complications arising from calculating in a Lorentz boosted frame and respective solutions have now been further analyzed, supporting more successful applications of the method to these problems. Most notably, full PIC 3D simulations of 10 GeV laser acceleration stages were enabled, with demonstrated convergence at a few percent level at various gammas, with speed-ups of 1,000 or more. Such simulations are important to the design of next generation accelerators. We will present and discuss the latest developments of the method illustrated with various examples of its application.

[1] J.-L. Vay, Phys. Rev. Lett. 98, 130405 (2007)